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AN ASSESSMENT OF CURRENT PURCHASING PRODUCTIVITY MEASUREMENT SYSTEMS

by

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An Assessment of Current Purchasing Productivity Measurement Systems

by

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ABSTRACT

Productivity has become one of the most important and misunderstood concepts of the 1970s and 1980s. There is a need for concise definitions and terminology regarding the subject. This study addresses the area of purchasing productivity measurement. The study surveyed private industry and Navy Field Contracting Activities in order to document what systems are currently used to measure purchasing productivity and to attempt to find optimal measurement factors for improvements to existing models. The research also discusses the impact that automation has had on purchasing productivity. This research was conducted through the use of a survey, a literature search and by interviews with Navy Field Contracting and private industry officials.

TABLE OF CONTENTS

I. INTRODUCTION

One of the most important concepts in business over the last several years has been that of productivity, specifically in how to make improvements to the rate of productivity growth. The diagnosis of many organizational performance problems has been given as poor productivity and the cure is stated as improvement to that organization's productivity. Upon review of the literature, it becomes apparent that the term productivity has several meanings. To engineers skilled in the manipulation of numbers, productivity means efficiency computed using input/output ratios. To those in the field of management, productivity is not only an efficiency measurement, but also includes quality factors to make up the larger measurement of organizational performance. Which group is correct has been the subject of much debate. Much more important than this debate, however, are the issues of developing a common technology of productivity and establishing methods of productivity measurement. Productivity improvement is dependent on knowing precisely what it is you are trying to improve as well as what level of productivity you currently have.

This study will investigate what the term productivity means both at Navy Field Contracting Activities and in the commercial sector in order to define productivity's meaning

related to procurement. The study will determine which indicators of purchasing productivity are currently measured at Navy Field Contracting Activities and the commercial sector. Special consideration will be given to efficiency and effectiveness factors contained in purchasing productivity measurement systems. The study will not only discuss the productivity indicators that are currently in use, but also will include factors that have been nominated by the study participants for an optimal purchasing productivity measurement system. The study recommends improvements to current purchasing productivity measurement methodologies based on the findings of this research.

The research effort undertaken by this study is best summarized by the research questions asked in conjunction with the thesis. The research questions were directed at determining what measures of purchasing productivity are currently being used, whether they can be improved and finally whether automated procurement tools would impact purchasing productivity. The research questions are:

Primary Research Question:

Is there an optimal measurement methodology for purchasing productivity?

Subsidiary Research Questions:

1. What is meant by the term "purchasing productivity?"
2. How is purchasing productivity currently measured?
3. How might effectiveness factors be included with efficiency measures in purchasing productivity measurement?

4. How might current measures of purchasing productivity be improved?

5. What are the characteristics of the APADE system that might impact on productivity?

6. How might a system like APADE be used to improve productivity?

The methodology used in this thesis consisted of three parts. The initial research was accomplished by a literature search to examine the extensive body of literature that exists for the field of productivity. Second, interviews were conducted with key management level individuals, both in industry and in Navy Field Contracting Activities. Interviews were conducted both in person and on the telephone. The purpose of these interviews was to obtain management's prospective on the issue of purchasing productivity measurement. All interviews were confidential and non-disclosure in nature to ensure candid answers. The final phase of the research for this thesis was conducted using a survey to collect information on productivity measurement from both Navy Field Contracting Activities and the commercial sector. The survey was aimed at the worker level to get first hand information from the field as to how purchasing productivity is currently measured and how best to measure it in the future. The survey was created and the results tabulated using a software package called Organizational Universe Survey System.

The two study groups in this thesis were, first, Navy Field Contracting Activities which are termed the military

group in the study and, secondly, commercial sector companies which were termed the industry group. In the industry group, an attempt was made to include both defense and non-defense related companies. Each prospective survey member was contacted in advance to obtain agreement to participate in the survey. While all military organizations contacted agreed to participate, several of the commercial sector companies, particularly in the defense related industries, declined to participate. It was felt that this may be a reflection of the adversarial nature that currently exists in defense contracting.

The research was limited in scope by the author to address the area of small purchase only. Small purchase is defined for the purpose of this report to be those purchases less than $25,000.00. It was felt that limiting the scope of the research to this area would expand the number of commercial sector companies in the survey group. Furthermore, this area is subject to less intensive review than are other areas of major procurement and therefore was more likely to produce findings that would be useful to the study participants.

This thesis is organized into six chapters. Chapter Two contains a discussion of the background of productivity measurement. A review of the literature is included as Chapter Three. Chapter Four presents the results of the interviews and survey. Results are tabulated separately for

military and industry interviews and surveys. The data presented in Chapter Four is analyzed and discussed in Chapter Five. Finally, in Chapter Six, recommendations and conclusions drawn from the data are made.

II. BACKGROUND OF THE PROBLEM

Productivity has captured the consciousness of American business as no other concept has in recent memory. Many authors talk about a productivity revolution that is global in nature. The sheer volume of literature surrounding the subject is overwhelming. Many see productivity as a panacea that will cure all economic ills and restore America as the preeminent leader in world economics. Yet for all the hoopla concerning productivity, there has been surprisingly little progress made in improving the rate of productivity growth. American productivity growth is less than virtually all of our industrial trading partners. It trails that of Japan, West Germany, France, Italy and Canada. (1:22) Despite this fact there is little agreement on how to best improve productivity in business today (2:42).

Perhaps one reason for the lack of productivity growth in this country is that productivity is a broad concept that encompasses many facets and relationships. There are significant differences of opinion in even defining what the term productivity means. While Americans have endorsed the medicine of productivity as a cure for a raft of economic ills, there is little agreement as to the actual formula to be employed. Productivity is defined differently in virtually any publication one chooses to read. Alan Lawlor,

in his book titled Productivity Improvement Manual, makes some revealing observations on the definition of productivity. For many, he says, the word productivity means strictly efficiency as measured on the factory floor using production and labor costs to compute ratios of efficiency. (2:4) However, the make-up of American business today is evolving. We are shifting from a manufacturing based economy to one heavily dependent on the services sector. In fact, governmental services make up a significant portion of this country's GNP. In 1900, government services made up 8% of GNP. In 1970, this number had risen to 33% and it continues to climb today. (3:208)

The question can reasonably be asked why measure productivity in the government sector at all? The answer is largely one of accountability. Government managers are charged with the responsibility to spend the public's funds wisely and to ensure that maximum benefits are obtained for the resources used. It is particularly important to measure productivity in government service as the marketplace and what Adam Smith called the "invisible hand" have very little influence on them. There are no regulating marketforces or profit motives that force consideration of efficiency and effectiveness issues. The stereotype of a civil servant, often reproduced in political satire, is one of a lazy worker who lives off the fat of taxpayer's dollars while providing very little in return. The lack of effective performance

indicators and productivity measurements have enhanced or perhaps even created this image. Productivity measurement should provide a means of evaluating workers' performance, monitoring utilization of resources and allow for comparisons between organizations. Unfortunately, current productivity measurement systems are not sufficient to accomplish these tasks.

The need for productivity measurement in government today mirrors productivity measurement in the private sector. This thesis adopts the view that government productivity measurement should account for not only efficiency issues, but also the areas of quality of the product or service and responsiveness to the public sector served. This view is in agreement with that of the United States Office of Personnel Management, which defines productivity as " ... the sum of the efficiency, effectiveness, quality and responsiveness with which products and services are delivered" (9:6). Older productivity concepts and measurement systems must evolve if significant growth in this country's productivity is to be realized. In today's environment, we must expand our rather myopic and dated approach to productivity measurement to look beyond mere measures of efficiency and include organizational effectiveness as well. Only by adopting this total concept approach will the true benefits of productivity measurement be realized. (2:4)

A. EFFICIENCY VERSUS EFFECTIVENESS

That a large number of organizations measure efficiency only is not surprising. Compared to the task of measuring such subjective areas as customer satisfaction and quality, efficiency measurement is relatively simple. However, measuring efficiency alone, when evaluating productivity, produces a pattern of employee behavior that reflects this one-dimensional measurement system. If the axiom you are what you eat is true, then a corollary for management would be, you are what you measure. One author says that measurement is a means of management control and employee manipulation in order to serve organizational needs. In reality what management is saying by measuring efficiency only is that it doesn't matter what you accomplish so long as it is done at the minimum cost. (3:37) A classic example of this theory is the story of the Russian nail factory. When the production goals were stated in tons of nails, factories produced only the largest sized nails. The factory thus maximized the gross weight of nails produced and did what it thought its government expected. When the standards were changed in the following year to measure output as quantities of nails produced, the factories produced only the smallest sized nails. Of course neither of these two extreme results were the outputs desired by the governmental policies on factory output. The lesson that this story illustrates is that management must carefully evaluate what parameters it

measures because these parameters will be adopted by the employees as management's desired behavior. Thomas Tuttle stated it as follows:

> What you measure is what you get. Measurement is much more than the passive recording of data. What you measure sends messages throughout the organization regarding what aspects of performance are viewed as important. Thus measurement guides and shapes performance of an organization. Therefore it is very important that the organization measure those things that are important, not those that are simply easy to measure. (4:17-18)

It is recognized by many authors that productivity is a measurement that should combine several characteristics to yield an overall assessment of organizational performance. The definition of productivity that is adopted by the author of this thesis is one that describes productivity as being composed of two component parts. Productivity can be described as the measure *of how* well an organization satisfies both its efficiency goals and effectiveness goals. (2:36) The dual nature of this definition of productivity represents a need for a balance between the desire to do things quickly and the desire to do things well. The importance of this duality was recognized in the Packard Commission Report on Defense Acquisition improvement. They stated in their report that implementation of their recommendations would make both " ... quality and productivity the hallmarks of Defense Acquisition" (5:42). The two measurements cannot be logically separated. Undesired results may occur if they are.

Treating productivity as a function of efficiency alone encourages short-range reasoning. Since efficiency ratios measure the amount of output obtained for a given amount of resources consumed in the creation of that output, to improve an efficiency ratio the manager has two choices. First, the manager can cut the costs of his inputs, where there is fat in the process to be cut, this produces better efficiency at no loss in quality. At some point however, a level is reached where further cuts in inputs will reduce the quality of the output. It is possible to have an extremely efficient organization that has very low effectiveness. Second, the output for a given quantity of resource input can be increased, but again the issue is that eventually the organization will reach a point where quality will suffer as a result. The idea that productivity should be more than the simple measure of efficiency has formed the framework of this study. It is the opinion of the author that it is critical for management to know how effective their organization is at accomplishing its objectives. Efficiency measures form a crucial segment of effectiveness measurement, but they do not tell the whole story. There is a need for the balancing measure of quality. In contracting this involves measuring the level of customer support provided as well as the quality of the contractual document.

B. PURCHASING PRODUCTIVITY

Productivity, then, can be defined as a measurement of how efficiency and effectively an organization accomplishes its objectives. In general, efficiency measures compare inputs to outputs to get a quantitative indicator of productivity. Effectiveness factors are harder to quantify and therefore are often dealt with in ways unique to each organization. Purchasing productivity can be thought of as consisting of two parts. The first is the efficiency factor which relates to how quickly and efficiently each buy is made. The second factor is the quality factor. It measures how "good" a buy was made. Some authors term these two separate aspects as purchasing efficiency and purchasing proficiency. Purchasing efficiency deals with workload measurement such as backlog of unplaced orders, orders placed per time period and order processing time. (6:566) Buying proficiency deals with such issues as source reliability, prices paid and customer support or satisfaction.

Many factors complicate the measurement of purchasing efficiency and proficiency, making comparisons between organizations or individuals very difficult to interpret. Each buying activity has unique responsibilities and variable functions that make comparisons difficult. The unit's method of organization, commodities purchased and relationship with customers or the organization as a whole can invalidate any comparisons or conclusions drawn from raw data. The universe

of contracting is so diverse and expansive that it is difficult to create standards for each situation and measure performance against these standards. Proficiency measures are even harder to develop than efficiency measures. It is essential, however, that quality be measured in some way to provide management the balanced picture of organizational effectiveness it needs. The purchasing manager's goal should be "to achieve a high degree of operation efficiency but not at the expense of buying proficiency". (6:567) This thesis will examine this precept and attempt to determine what systems are used in industry and government to measure purchasing proficiency as well as purchasing efficiency.

C. PRODUCTIVITY IMPROVEMENT THROUGH AUTOMATION

There have been many different approaches taken throughout industry and government to use technology in the solution of productivity problems. Robotics and automated machinery are becoming commonplace in manufacturing and production today. In the office environment, managers have attempted to boost productivity through the use of automation and computers. An example of such a system in military procurement is the Automation and Procurement and Accounting Data Entry System (APADE). APADE is a decision support system that attempts to automate many aspects of the acquisition process. It was developed by the Navy for use in Naval Supply Systems Command activities. Although portions

of APADE have been implemented at virtually all Naval Supply Centers, complete installation of the system's capabilities has not yet occurred. Economic analysis predicted productivity increases would average 15% for the APADE system, resulting primarily from more efficient use of contract buyers' time. The impact that a system like APADE can have on purchasing productivity is one of the focuses of this thesis.

It was recognized by the Navy in 1971 that automation of the procurement process would be beneficial. At the start, the research and development effort on the system focused on the automation of source data to allow aggregation of data, improved management and report generation. The research and development effort also included the requirement for a pilot test site to demonstrate the capability to successfully automate source data information. The system was designed by a contractor as a Management Information System and was completed in 1979. The resulting product did not satisfy the objectives and requirements of the functional manager. A functional redesign was authorized and finished in 1983 to improve system documentation, rework the system's modular design and to correct the deficiencies uncovered by the functional manager. (7:2-10) At each step along its evolutionary path, APADE has retained some of the features of earlier designs. There is substantial report generation

capability as well as other MIS segments associated with the current system.

The road to procurement automation through APADE has been a long one, fraught with setbacks and delays. As stated in the Procurement Action Task Force's report on APADE, the reasons for this were many. The study found that systems designs failed to be properly defined or standardized (8:1). One of the most basic steps in development of any software system is that the user must define what it is that the software must do. In fairness to the original system designers, procurement is a highly dynamic field that is carefully watched, regulated and legislated. Flexibility and responsiveness to change are facts of life for the modern federal procurement professional. There was also significant resistance to the implementation of a centrally managed procurement automation system. Many of the candidates for APADE had already developed local computer systems. A further complicating factor is that initial productivity measurements for the APADE system have not shown the projected productivity gains. The question of whether this is a function of the automated procurement system or a function of how productivity measurements were made will also be explored in this study.

III. REVIEW OF THE LITERATURE

The amount of literature written on the general subject of productivity is staggering. This fact alone is evidence of the subject's importance to modern management and business. Most of the written material reviewed dealt exclusively with productivity measurement as a function of efficiency. In contrast, several texts devoted only a page or two to the issue of quality or effectiveness measurement. There was general agreement that these aspects of productivity were important and should be considered by management, but any substantive discussion of the topic was left out. This was in direct contrast to the excruciating level of detail that many authors devoted to the subject of efficiency measurement. Many of the books on productivity were written by industrial engineers, and their ideas on productivity reflected their discipline. These authors seemed much more comfortable in discussing the measurement of parameters that were easily quantifiable as opposed to such areas as quality and customer satisfaction. From the mass of literature available, the author of this thesis selected works that deal with productivity in the service sector, productivity measurements that incorporate the effectiveness factor and studies that discuss automation of the procurement

process for review in this chapter. Special attention was devoted to include articles that dealt with purchasing productivity measurement.

A. PRODUCTIVITY IN THE SERVICE SECTOR

In his book titled Productivity in Service Organizations, author Herbert Heaton makes several useful observations and proposes a model to measure service productivity. He discusses the work of the early pioneers in the field of productivity measurement, such as Fredrick Taylor, who used time and motion studies to derive mostly efficiency measures of worker performance. The author states that this strict efficiency interpretation of productivity is inappropriate for measurement of service sector productivity. He argues that productivity in the service sector should be measured by a combination of multiple factors and tracked as an annual rate of change. (3:174-175)

The proposed Heaton model measures four factors which are combined to yield one measure of organizational productivity. The first factor, which Heaton calls the input factor, is measured to determine the percentage of all legitimate work that is received from customers. For example, there is usually some fraction of the requisitions received by a purchasing organization that will be cancelled by the customer before the buy is made. The fraction of remaining valid work would be the input measure used. Secondly, a determination of the processing skills of the unit is made.

This is really an organizational effectiveness measure and thus is stated as a percent effectiveness. Third, output follow up is measured as a percentage of the total work effort. Output follow up can be thought of as the work required after the process has been completed to correct errors. An example would be corrective contract modifications made by a contract administration staff to fix errors found after a contract had been awarded. Finally, a measure of overall timeliness is made and expressed as a percentage of on time performance. When these four percentages are multiplied together, a measure of an organization's gross productivity is obtained. Heaton says that this measure is seldom larger than 20%. This measurement, tracked over time and subjected to trend analysis, provides management a tool with which both changes in productivity and their causes can be detected. (3:45)

Heaton continues in his article to say that profit seekers use budgets to control profits and costs. Non-profit organizations, in contrast, find that budgets are authorizations to incur costs without measurement of the results achieved. Government budgets are incremental, in that they are granted on an annual basis. They are opportunistic in that new activities are added when circumstances, as in the military's recent defense buildup, allow for additional funding. This is in contrast to a system that increases services when productivity demonstrates

that a program is effective and should be expanded.(3:40) The service sector is to a large part immune to the forces that determine success and failure in the business world due to the lack of an effectiveness measurement scheme. Heaton states that "Things that are not measured are not controlled".(3:37) Regarding the manufacturing of physical goods, he says that the competitive marketplace is assumed to control effectiveness. Most Government services, however, do not face a competitive situation and therefore a monopoly exists. For example, there is only one Department of Motor Vehicles, so that if you want a drivers license you must deal with them. Finally, the author said that the service sector deals with individual needs, rather than those of aggregated consumers. This tends to reinforce the monopolistic situation that already exists in the service sector. (3:174)

B. PURCHASING PRODUCTIVITY

While Heaton proposed a methodology to measure an organization's gross productivity, he did not address the very critical issue of how the various measures in his model are to be quantified. It is important to know what factors should be measured, but one is no closer to a solution until these factors can be determined and defined in ways meaningful to the specific organization using the measures. Authors Dennis Wright and Patrick Cummings addressed this problem in their masters thesis titled, Purchasing Productivity Measurement Systems. They stated that each

contracting organization must define for itself the outputs to be measured due to the complexity and diversity inherent in every contracting organization. The authors stated that no one system would suit the needs of every organization and manager.(10:80) There is a large degree of merit in what these authors have to say. It is important to know what the organization defines as good performance and what the organization's objectives are. Different contracting organizations can have very different definitions of desired performance. While cost consciousness may exclusively define one organization's idea of desired performance, production support and material quality may be the emphasis of another. The idea of good performance by individuals is a more subjective decision made by management based on experience with the buyer. Performance of individuals reflects their understanding and acceptance of both organizational goals and desired behavior patterns. Understanding this, the manager can act to design a performance management system that will allow him to track key performance parameters while sending a consistent message on the organization's desired goals and objectives to all employees.

If one is going to discuss productivity at Naval Supply Systems Command contracting activities, how these activities are funded cannot be ignored. Funding has a critical impact on both productivity measurement and in defining management objectives. The Naval Supply Systems Command (NAVSUP)

provides essentially all the funds that their subordinate activities will receive during the year to meet the payroll, pay utility bills and operate in order to provide services. In NAVSUPINST 7000.21A titled, "Productive Unit Resourcing at Naval Supply Systems Command (NAVSUP) Field Activities", the funding procedures are discussed. The impact that these procedures have on purchasing productivity is enormous. The concept of operations under the Productive Unit Resourcing System (PURS), is stated in the instruction, as follows:

> Under the productive unit resourcing system, NAVSUP commits to fund workload at the required level of performance, i.e., field activities will be funded on the basis of actual work performed vice the fixed workyear/cost funding methodology used previously. The activity assumes the responsibility to reduce the unit cost of processing work. (11:1)

The impact that this system has on productivity is expressed through the way that it distributes funds to activities. Each year individual commands negotiate with NAVSUP to establish a cost rate for purchase actions. First, each activity must estimate the number of purchase actions that its various customers, which range in diversity from Naval shipyards to aircraft carriers will submit during the upcoming year. Workload is forecast as actual numbers of contracts that will be awarded in the coming year. Each purchase award is called a productive unit. Secondly, the activities must project what costs they will incur in order to meet this level of activity. By dividing cost by projected workload a rate is established that can be used to

fund actual work over the year. This rate is called the Productive Unit Resource rate and it is this rate that is negotiated with NAVSUP before a final business plan can be established for each command. The PUR system applies to all areas of activity within commands. Contracting is only one of the services that these activities provide. Throughout the year costs and workload statistics are tracked. NAVSUP will only pay the activity for work that is actually done and will only use the negotiated rate to compute the amount of reimbursement to be authorized. If the cost estimates that were used to predict the PUR rate for contracting are too low, the command will be under funded and must balance the books by shifting funds from another functional area into contracting. If the activity becomes more efficient or accumulates more than the predicted number of productive units, it will operate under projected cost. The savings will be shared between NAVSUP and the activity according to a predetermined share ratio.

This is a simplification of the process for small purchase items, but serves to illustrate the impact that the PUR system has on productivity. Each command gets its funding from a system in which total resources are the result of a negotiated rate multiplied times the number of contract awards (productive units). The only way for an activity to generate operational funds is to make contract awards. It should be clear that the emphasis from the activity's point

of view is to make contract awards as quickly and as cheaply as possible. Since the activity shares in any of the excess "profits" generated, there is significant pressure to generate more output in order to accumulate additional funding that can then be used as the activity sees fit. Many activities now have output goals for individual buyers stated in terms of productive units that must be obtained per hour. The benefits of the program as seen from NAVSUP's perspective are listed in the instruction as:

> ...expected gains in workforce productivity, economy of operations, a more flexible workforce, performance based incentive systems, specifically defined performance goals and management of overhead type costs. (11:1)

The emphasis for productivity under this system is on efficiency and output, directed at meeting or exceeding predicted workload and cost factors. Organizational effectiveness and quality are unmeasured by the Productive Unit Resourcing System.

Some authors feel that all parameters to be included in a productivity measurement system should be decided at the activity level. This opinion is not universal. Several authors state that it is possible to create a model for performance measurement that can be further tailored by individual activities to include the specifics that are unique to their missions. Such a system was developed in an Air Force report, issued in 1979 and titled "Contracting Productivity Measurement at the Base Level". This study attempted to evaluate purchasing productivity measurement at

local activity levels and to develop a general model for productivity measurement. The author gave four reasons to measure productivity, which are:

1. It allows trend analysis of current performance with past performance.
2. When changes are made to operations, productivity measurement allows for quantification of the impact.
3. It identifies areas that require training.
4. It alerts contracting personnel as to what management feels is good performance and encourages behavior that meets these performance indicators. (12:1)

Given the fact that it is important for management to measure productivity, the authors then addressed the problem of how such a measurement system should be designed. They felt that the system should require only simple calculations, that these calculations could be made in a short time and that the results should be readily understandable by both management and workers. The author deeply felt that if the measurement system became too complex or cumbersome, then it would not be used. The study used surveys, which were sent to all Air Force contracting activities with more than ten contracting personnel assigned, to collect data. The survey listed various productivity measurement parameters and asked the survey recipients to rate the usefulness of each. Interviews were conducted with each contracting office's principle customers to determine what they considered to be the key measures of success for a contracting activity.

The results of the interviews showed two primary measures that were important from the customer's perspective. Timeliness of response to their request for procurement was the most important measure cited. This measurement area included such actions as follow up on delinquent requisitions, establishing reliable vendors and performance against the established military time standards (UMMIPS) for requisition processing time. Secondly, quality was listed as very important to customers. Quality was defined as getting what the customer wanted, as opposed to incorrect or unacceptable substitute items. (12:8)

The interview and survey results lead to the development of a productivity measurement system by the author. Two general areas were included in this model, efficiency measures and effectiveness measures. In the area of efficiency, standard input/output ratios were computed to yield measurements of buyer and resource efficiency. In the area of effectiveness the following measures were proposed:

1. Quality of the buy as measured by customer submission of item deficiency reports.
2. Timeliness as measured by the percent on time date and contact delivery date.
3. Price paid justifications computed using sampling techniques for awarded contracts. Ratios are computed by dividing actual costs by an average of historical costs yielding a price effectiveness ratio.
4. Economic program support ratios are computed by dividing program goals, such as small business contract award goals, into actually awarded program contracts. (12:9-16)

Efficiency and effectiveness factors are tracked over time so that changes can be detected and investigated.

The author concluded that both effectiveness and efficiency measures must be included in any system that measures purchasing productivity. He felt that the area of small purchasing should be evaluated for productivity first, because there is currently less scrutiny in this area than in other contracting disciplines. Finally, the author said that each contracting activity must tailor its productivity measurement system to meet its own unique needs. He felt it was impossible to define universal optimum performance standards or goals and, therefore, measurement system design should incorporate local preferences in organizational goals and objectives. (12:17)

It is important to consider not only how to measure productivity, but also how improvement in productivity levels can be made. In order to improve productivity, it is critical to know what the workers perceive as the primary roadblocks to their own productivity. American industry has had a great deal of success recently in identifying these stumbling blocks by borrowing the Japanese concept of Quality Circles. A Navy study that evaluated what contracting professionals saw as impediments to their productivity was titled, "Productivity Measurement in United States Navy Contracting". The study used a survey to define what contracting personnel felt were the major impediments to

productivity and what improvements were possible. The single biggest contributor cited as a source of reduced productivity was the amount and rapidly changing nature of the laws and regulations surrounding the contracting world. Contracting professionals felt that this severely reduced their flexibility, and in effect tied their hands when dealing with their counterparts in the commercial world. Contracting personnel also felt that there was a shortage of qualified administrative personnel assigned to their activities. They said that far too much of their time was spent performing, reviewing and monitoring routine administrative matters in order to meet deadlines and commitments. As a result they felt that they could be significantly more productive if given additional administrative support. Finally, the respondents to the survey felt that there should be increased autonomy in the workplace. This was expressed as both a desire for more autonomy in local matters as well as the larger scale problem of over regulation of the profession from without. (13:88-96)

C. PRODUCTIVITY AND AUTOMATION

Purchasing has traditionally been a labor intense, repetitive and stressful vocation. There are always deadlines to meet, shortages of trained personnel, manual document preparation systems and often the information that a buyer needs to complete an action, such as price histories or contract folders, is difficult to retrieve from hardcopy

storage locations. Automation in the procurement profession could make a significant contribution to eliminating some of these problems. The acquisition profession has historically suffered from a certain lack of attention in the commercial world. As business conditions have become more competitive, companies are beginning to realize that each dollar saved or lost by its contracting organization represents a dollar of profit or loss respectively to the overall company bottom line.(14) Companies are beginning to invest in their purchasing organizations and give them the automation tools they need to be more effective. Government procurement faces a different set of constraints. Profit has not been the factor that has driven government to invest in automation equipment. Instead, automation is being used due to shrinking levels of funding and personnel, coupled with increasing levels of service demanded and a zero defect mentality which have forced government to accomplish more with fewer resources.

In many ways automation is the ideal solution to many of today's most prevalent procurement problems. It can have a huge impact on an organization's productivity. Authors Robert Young and David Goodwin say it this way:

> Automation as a tool for procurement effectively increases productivity in three ways. First, it performs repetitive administrative tasks, thereby reducing or eliminating manual preparation of documents or the repetitive entry of data. Second, it provides for the storage and rapid retrieval of data that buyers need for transacting business and that managers need for effective control . Finally, it aids in some of the evaluative and

> analytic tasks required to select contractors and establish contract prices. In all instances, automation expedites the performance of required functions, reduces the opportunity for error and in some cases it reduces the number of personnel needed to perform the task. (15:ii)

In their study for the Logistics Management Institute, titled, "Automation-- a Tool for Procurement", Authors Young and Goodwin found that procurement is an ideal field for the application of modern automation techniques. They visited DOD procurement offices to determine the impact that automation systems have had on procurement operations. They found that in the installations that have begun to use automated systems, individual productivity has improved, manual processing time has been drastically reduced and the same number of people can process more work after automation than before. They found that the degree of automation used varied widely in the activities visited. The authors found that not all the automation systems they saw were effective. There was a certain degree of user resistance at some commands that arose from the following causes:

1. Natural reluctance to change.
2. Anxiety about job security.
3. Skepticism brought on by poor automation systems in the past.
4. A system that is not responsive to the users needs. (15:2-6)

The study concluded that automation has significant potential to improve productivity in procurement activities. It stated that much of the user resistance could be

eliminated if a central automation coordinator was established at each command to act as an advocate and to plan the transition from manual to automated operations. The study further recommended that automation developmental efforts, such as the APADE system, should be given a high priority for deployment due to the potential for improvement.

One example of a commercial purchasing system that is automated appeared in an article titled, "Improving Purchasing Productivity at IBM with a Normative Decision Support System". The system is called the Vendor Selection System. It goes far beyond mere automation of data entry and organization of retained files in a computerized retrieval system. This system actually makes recommendations to the buyer as to which vendor to use. The problem that the system's creators were trying to solve was how to "...obtain needed materials and parts at lowest cost while meeting noncost criteria such as quality and reliability of supply" (16:106). The authors cite many reasons for the need for automation in procurement. One of the most important of these is industry's move to the Just In Time inventory model. This approach requires very precise material delivery schedules and tight coordination between production and purchasing. Another factor in today's procurements is the large volume of business done overseas with the associated currency exchange and legal complications. Finally, the authors discuss the need to improve productivity in the

procurement function in order to improve overall company productivity. The authors state:

> ...the emphasis here cannot be naively quantitative increasing purchasing volume or the number of contracts signed per buyer, for instance - since this is unlikely to significantly decrease total purchasing costs. Rather, management must emphasize improving the quality of the decisions made by purchasing personnel. In purchasing, productivity is a matter of getting more value for the purchasing dollar and integrating procurement more closely with other operations.

The article states that the key to improving productivity in procurement is to replace seat of the pants decision making processes with today's "powerful normative decision support technology". (16:107-109)

IV. PRESENTATION OF THE DATA

This chapter will present the results of the surveys and interviews conducted with both industry and public sector contracting professionals as research for this thesis. Interviews were conducted both in person and on the telephone. The identities of the individuals surveyed and interviewed is confidential material as requested by several of the participants. Twenty-two interviews were conducted with military contracting officials and fifteen interviews were conducted with industry procurement professionals. Both of these groups were comprised principally of management level personnel. One hundred and eight total surveys were mailed to both experienced and unexperienced buyers. Fifty-six percent of the surveys were sent to private industry and forty four percent were sent to military contracting personnel. Sixty-seven surveys were returned for a response rate of sixty-two percent. A copy of the survey used in this study is provided as Appendix A. Interview results with industry will be discussed first followed by military interview results and finally the survey results.

A. INTERVIEW RESULTS

The interview used with industrial contracting personnel was in two parts. First, several basic questions about the

nature of each individual purchasing organization were asked, followed by questions about how that organization measured purchasing productivity. The basic questions asked of all industrial procurement interviewed were:

1. How is your purchasing unit organized?
2. What is the annual dollar value of contracts let in your organization?
3. How many buyers do you supervise?
4. Do you use a separate contract administration staff after contract award?
5. Is your procurement organization automated?

The size of the contracting organizations interviewed ranged from annual business levels of eleven to 350 million dollars and between three and sixty individuals supervised. All of the industry purchasing organizations used a cradle to grave approach for contract administration. No separate contract administration staffs were used after contract award. It was the buyer's responsibility to get good material into the users hands. All but one of the industrial buying organizations used some sort of automation tools to help track and process procurements. These systems ranged in complexity from very sophisticated to relatively simplistic. Most industry purchasing groups were organized by commodity. Nine of the fifteen were commodity organized, three were organized by program and then by commodity within each program, two were organized strictly by product line and one company used no special organization.

Responses to the questions on the productivity measurement indicators currently being used at the companies being interviewed ranged from descriptions of elaborate tracking systems to no system used at all. Many companies indicated that they used a combination of indicators for best results. Responses to this question are provided in Table 1 on the following page.

The interviews with military procurement professionals fell into two categories. Headquarters level personnel that were responsible for policy matters in military procurement were interviewed first. Interviews were then conducted with military field contracting professionals to determine the key indicators that were used at field management levels to measure purchasing productivity. The interviews with the field level contracting professionals indicated that their management goals and objectives mirrored those of the policy level managers. It was clear from the interviews that the desires of policymakers had been adopted as goals at the field level. In no area was this more clear than in the Productive Unit Resourcing System. Field units in the Navy have adopted this system, in many cases, as the sole determinant of their contracting organization's performance. Activities have created purchasing standards for buyers based completely upon meeting PURS goals which are issued on an annual basis. As a result, with the exception of backlog measurement and compliance with PURS goals measurements

TABLE 1--INDUSTRY PRODUCTIVITY MEASUREMENT INDICATORS
(Determined by interview with industry management)

	INDICATORS	FREQUENCY
1.	Overdue material reports.	6
2.	Actual costs compared to historical costs.	5
3.	Backlog of unpurchased items	4
4.	Contract change orders as a measure of contract errors.	4
5.	Support review meetings with customers.	4
6.	Actual costs compared to budgeted costs.	4
7.	Contracts awarded by buyers in dollars or numbers.	3
8.	Percent rejected materials.	3
9.	Audit of selected contract files.	2
10.	Error rate determination by supervisors.	2
11.	Time to process a requisition or buys per unit time.	2
12.	Procurement costs as a percent of total program costs.	1
13.	Customer feedback forms.	1

(measured as buys made per hour and stated to buyers as required hourly goals for contract awards) very few other management indicators are measured. Only two interviews indicated any consistent internal review or audit of contract folders and those that did have such a program did not report the findings to management so that trends could be analyzed. Several activities said that they monitored customer service or satisfaction levels, but the methodology was that of negative information; if there are no complaints, then there must be no problems.

The interviews indicate that military contracting organizations exclusively use the concept of a separate contract administration staff. The contract administration group takes responsibility for managing a contract after award. This fact is driven to a large degree by the large volume of contracts issued by these activities and the policy emphasis of making contract awards as quickly and efficiently as possible. Virtually all of the military contracting activities were a great deal larger than industry purchasing units in this study. This is a function of the Navy's decision to centralize procurement into regional procurement centers. Using a contract administration staff is in direct contrast to the finding of the industry interviews where no industry contracting organization used a contract administration staff. Industry procurement units, in general, support one area of production which has fairly well

defined needs. The military activities' customers range from ships to shipyards. There is tremendous diversity in both the types of materials ordered and the urgency of need. In the military contracting interviews there was a great deal of importance placed in how quickly things got done. How well things were done, in terms of contract vehicle quality and the quality of the buy, was a concern to all the military managers interviewed, but there were very few systems that provided any useful data to the manager in this area. Most managers spoke of the need for this type of data, but admitted that quality in the contracting world was a very difficult concept to measure and manage.

The degree of automation that each purchasing activity had achieved was addressed in the interviews. Industry managers indicated that most of the systems currently in use were document tracking or word processing packages. Some of the larger companies had more sophisticated systems, but their use was generally limited to tracking financial data for reports to higher company levels. The one exception to this situation was in the area of cost performance. A few of the industry interviews discussed models that were used to compare actual costs for material against historical or average costs. The models generated cost performance reports that tabulated the funds lost or saved by prudent purchase action down to the individual buyer level.

As previously stated, the interviews indicated that military procurement organizations had universally accepted the APADE system for automated procurement. From a management perspective the system was liked because it provided the information needed for workload management, namely compliance and performance against PURS goals. Users of the system said that initially they had reservations about the system but were generally happy with the switch.

Two observations are germane with regard to APADE. First, it is very difficult to make any statement about whether APADE has helped or hurt productivity in the very brief time since implementation at most activities. The reason for this is that most activities that were visited or interviewed used the same procedures to calculate productivity but several counted the input data differently. The input data for this measurement are the numbers of contracts awarded during a period and the number of buyer hours used to make these awards. These values were not consistently tabulated across the several activities interviewed, which makes productivity comparisons between organizations meaningless. Further complicating the problem, there have been some policy level changes directed that changed the baseline productivity measurements during the APADE implementation cycle. The second observation that bears on the discussion of APADE as it relates to productivity measurement is that when APADE was implemented

at activities, there was no guidance on the most effective organizational arrangement to take advantage of the APADE system. The result, in many cases, was that the APADE system was merely laid on top of the manual organizational structure that existed before APADE. This added confusion to the already turbulent process of adapting to the APADE system and perhaps contributed to initial reported drops in activity productivity after APADE.

Interviews with policy level personnel confirmed that there have been several baseline policy changes in the way that productivity has been measured at field activities. The latest of these changes was issued in February of 1988 and was aimed at standardizing the way that activities count the buyer's hours for computing productivity. At the policy level, field contracting effectiveness is defined in essentially two ways. First, conformance to the PUR System is carefully evaluated by tracking each activity's progress against annual goals. Statistics are also monitored for the backlog of unpurchased requirements at each activity. Secondly, activity compliance with the myriad of procurement laws and regulations is evaluated by the Procurement Management Review Inspection given once every three years. There are no headquarters level measurements of quality other than the Procurement Management Review Inspection and an open ear to complaints from individual activity customers. The predominant headquarters concern was to manage the scarce

resources that were available to them and still be able to accomplish their diverse, complicated and enormous mission. The monitoring of quality is left to individual activities.

B. SURVEY RESULTS

The survey used in this study was created using a software program called the Organizational Universe Survey System (17). The survey consisted of two sections. The first part asked for responses to the following questions:

1. What specific measures of purchasing productivity are used in your organization?
2. What efficiency factors do you think could be included in purchasing productivity measurement to give the best results?
3. What quality factors do you think could be included in purchasing productivity measurement to give the best results?

The raw survey data was entered into the Organizational Universe Survey System software, which tabulated the results separately for military and industry surveys. Tables Two and Three show the productivity measurement systems used by military and industry survey respondents respectively, indicating both the system and the frequency that it was cited in the survey responses. Tables Four and Five list the efficiency factors that military and industry survey participants felt would be useful in a purchasing productivity model. Finally, Tables Six and Seven provide the data on quality factors that survey participants felt would be useful in a purchasing productivity model. Each table

lists the actual systems used or recommended and the frequency that each particular system was cited in the surveys for each group. It should be noted that not all survey participants answered all questions. Therefore, total frequency may not match the number of survey participants. Also frequency of response totals reflect the fact that several survey participants gave several responses.

TABLE 2--INDUSTRY PRODUCTIVITY MEASUREMENT SYSTEMS
(determined by survey response)

SYSTEM	FREQUENCY
1. Backlog counts of unpurchased items (Both aged [4] and raw backlog counts [9])	13
2. Delivery schedule monitoring to track delinquent items past delivery	9
3. Buys made per unit time	6
4. Material deficiency reports to track quality of purchased parts	4
5. Cost savings comparing actual to historic or projected price	4
6. Customer satisfaction reports	3
7. None used at all	3
8. Contract change orders to track errors due to contract personnel	2
9. Audits of selected contracts after award	2
10. Comparisons of actual to budgeted costs	1
11. Number of contracts awarded by a buyer	1
12. Dollars spent on premium freight	1

TABLE 3--MILITARY PRODUCTIVITY MEASUREMENT SYSTEMS
(Determined by survey response)

SYSTEM	FREQUENCY
1. Number of buys made per unit time	21
2. Backlog counts or age of unpurchased items	3
3. Internal audits to uncover errors	2
4. Productive Unit Resource System	1
5. Customer feedback	1

TABLE 4--INDUSTRY RECOMMENDED EFFICIENCY FACTORS
(Determined by survey response)

FACTOR	FREQUENCY
1. Buys made per unit time	7
2. Average time to make a contract award	4
3. Count of unpurchased items	4
4. Count of unpurchased items older than a given age	2
5. Time to prepare quotes	1
6. Time required to get a response to a quote request	1
7. Time to complete technical research	1

TABLE 5--MILITARY RECOMMENDED EFFICIENCY FACTORS
(Determined by survey response)

FACTOR	FREQUENCY
1. Backlog of unpurchased requests	7
2. Contracts awarded per unit time	3
3. Aged backlog lists	1

TABLE 6--INDUSTRY RECOMMENDED QUALITY MEASUREMENT FACTORS
(Determined by survey response)

	FACTOR	FREQUENCY
1.	Internal review and audit of contracts awarded	12
2.	Percent on time delivery for contracted items	9
3.	Cost of resolving non-conforming purchased material	7
4.	Cost performance compared to historical or projected cost	5
5.	Contract modifications to correct errors	4
6.	Customer error rate (incorrect or missing requisition data)	3
7.	Claims arising from poor contract specifications or provisions	1
8.	Customer delivery follow up requests	1
9.	Accounts payable error rates due to contract errors	1
10.	Customer feedback	1

TABLE 7--MILITARY RECOMMENDED QUALITY MEASUREMENT FACTORS
(Determined by survey response)

	FACTOR	FREQUENCY
1.	Errors found through internal audit	15
2.	Error rate found by counting contract modifications	6
3.	Percent on time material delivery	3
4.	Quality reports that show percent incorrect or non conforming material	2
5.	Customer complaints	1
6.	Contractor protests	1
7.	Vendor rotation	1
8.	Formal staff and legal reviews	1
9.	Contract errors due to incorrect customer supplied information	1
10.	Payment delays to contractors	1
11.	Cost analysis to determine fair and reasonable price	1

The second part of the survey asked for numeric responses to several scaled questions indicating the strength of agreement that the survey participant felt related to the question. A response of one indicated agreement to little or no degree, two to a slight degree, three to some degree, four to a moderate degree, five to a considerable degree, six to a great degree, and seven to a very great degree. Several questions in this survey have been singled out in Table 8 due to their particular relevance to this thesis and the research questions proposed within it for further discussion in the next chapter. These questions show the mean value of the response and the standard deviation associated with that mean response value for both military and industry surveys. Survey results for all survey questions are provided as Appendix B.

TABLE 8--RESULTS OF SELECTED SURVEY QUESTIONS

1. To what degree do you feel that it is useful to measure purchasing productivity?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	0		
2	3	*****	(10.3%)
3	5	*********	(17.2%)
4	7	************	(24.1%)
5	3	*****	(10.3%)
6	4	*******	(13.8%)
7	7	************	(24.1%)

MEAN 4.72 STANDARD DEVIATION 1.73

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	1	**	(2.6%)
2	1	**	(2.6%)
3	1	**	(2.6%)
4	8	**********	(21.0%)
5	9	************	(23.7%)
6	10	**************	(26.3%)
7	8	**********	(21.0%)

MEAN 5.24 STANDARD DEVIATION 1.44

2. To what degree do you feel that productivity objectives are measurable?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0....10....20....30....40....50	
1	0		
2	3	*****	(10.3%)
3	9	**********	(31.0%)
4	9	**********	(31.0%)
5	4	*******	(13.8%)
6	3	*****	(10.3%)
7	1	**	(3.5%)

MEAN 3.93 STANDARD DEVIATION 1.28

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0....10....20....30....40....50	
1	0		
2	1	**	(2.9%)
3	5	*******	(14.3%)
4	8	**********	(22.9%)
5	13	**********	(37.1%)
6	5	*******	(14.3%)
7	3	*****	(8.6%)

MEAN 4.71 STANDARD DEVIATION 1.23

3. To what degree do you feel that purchasing productivity should measure both efficiency factors and quality factors?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	1	**	(3.5%)
2	2	****	(6.9%)
3	7	**********	(24.1%)
4	3	*****	(10.3%)
5	7	**********	(24.1%)
6	3	*****	(10.3%)
7	6	**********	(20.7%)

MEAN 4.59 STANDARD DEVIATION 1.76

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	0		
2	0		
3	2	***	(5.4%)
4	2	***	(5.4%)
5	9	**********	(24.3%)
6	8	**********	(21.6%)
7	16	**********	(43.2%)

MEAN 5.92 STANDARD DEVIATION 1.19

4. To what degree do you feel that the most important factor in productivity measurement is efficiency?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	2	****	(6.9%)
2	5	*********	(17.25)
3	7	**********	(24.1%)
4	5	*********	(17.2%)
5	3	*****	(10.3%)
6	7	**********	(24.1%)
7	0		

MEAN 3.79 STANDARD DEVIATION 1.63

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0....10....20....30....40....50	
1	0		
2	2	***	(5.3%)
3	3	****	(7.9%)
4	7	*********	(18.4%)
5	11	**********	(28.9%)
6	9	**********	(23.7%)
7	6	********	(15.8%)

MEAN 5.05 STANDARD DEVIATION 1.37

5. To what degree do you feel that quality of buy factors are the most important in measuring purchasing productivity?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0....10....20....30....40....50	
1	0		
2	0		
3	3	*****	(10.3%)
4	2	****	(6.9%)
5	9	**********	(31.0%)
6	9	**********	(31.0%)
7	6	**********	(20.7%)

MEAN 5.45 STANDARD DEVIATION 1.21

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	0		
2	0		
3	1	**	(2.6%)
4	4	******	(10.5%)
5	11	**********	(29.0%)
6	13	**********	(34.2%)
7	9	**********	(23.7%)

MEAN 5.66 STANDARD DEVIATION 1.05

12. To what degree does your Purchasing Organization depend on productivity standards to determine individual buyer effectiveness?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	5	*********	(17.2%)
2	7	************	(24.1%)
3	4	*******	(13.8%)
4	5	*********	(17.2%)
5	4	*******	(13.8%)
6	17	*******	(13.8%)
7	0		

MEAN 3.28 STANDARD DEVIATION 1.71

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	0		
2	1	**	(2.6%)
3	0		
4	2	***	(5.3%)
5	4	******	(10.53)
6	17	**********	(44.7%)
7	14	**********	(36.8%)

MEAN 6.05 STANDARD DEVIATION 1.06

13. To what degree does your Purchasing Organization depend on productivity measurement to determine overall departmental effectiveness?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	3	*****	(10.3%)
2	7	**********	(24.1%)
3	4	*******	(13.8%)
4	6	**********	(20.7%)
5	3	*****	(10.3%)
6	4	*******	(13.8%)
7	2	****	(6.9%)

MEAN 3.66 STANDARD DEVIATION 1.82

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	0		
2	0		
3	0		
4	2	***	(5.3%)
5	4	******	(10.5%)
6	13	**********	(34.2%)
7	19	**********	(50.0%)

MEAN 6.29 STANDARD DEVIATION .87

14. To what degree does your Purchasing Organization use automation to assist buyers?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	3	*****	(10.3%)
2	1	**	(3.5%)
3	3	*****	(10.3%)
4	5	*********	(17.2%)
5	9	**********	(31.0%)
6	7	**********	(24.1%)
7	1	**	(3.5%)

MEAN 4.41 STANDARD DEVIATION 1.64

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	2	***	(5.3%)
2	1	**	(2.6%)
3	3	****	(7.9%)
4	5	*******	(13.1%)
5	4	******	(10.5%)
6	11	**********	(29.0%)
7	12	**********	(31.6%)

MEAN 5.34 STANDARD DEVIATION 1.74

15. To what degree do you feel that the use of automation improves purchasing productivity?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	0		
2	0		
3	2	****	(6.9%)
4	5	*********	(17.2%)
5	6	**********	(20.7%)
6	8	**********	(27.6%)
7	8	**********	(27.6%)

MEAN 5.52 STANDARD DEVIATION 1.27

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	2	***	(5.3%)
2	0		
3	7	*********	(18.4%)
4	3	****	(7.9%)
5	6	********	(15.8%)
6	11	**********	(30.0%)
7	9	**********	(23.7%)

MEAN 5.11 STANDARD DEVIATION 1.72

18. To what degree can purchasing productivity statistics be compared between individuals?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	4	*******	(13.8%)
2	5	*********	(17.2%)
3	6	**********	(20.7%)
4	9	**********	(31.0%)
5	2	****	(6.9%)
6	2	****	(6.9%)
7	1	**	(3.5%)

MEAN 3.34 STANDARD DEVIATION 1.56

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	2	***	(5.3%)
2	1	**	(2.6%)
3	6	********	(15.8%)
4	7	*********	(18.4%)
5	8	**********	(21.0%)
6	8	**********	(21.5%)
7	6	********	(15.8%)

MEAN 4.74 STANDARD DEVIATION 1.66

19. To what degree can purchasing productivity statistics be compared between work groups?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	4	*******	(13.8%)
2	5	*********	(17.2%)
3	7	************	(24.1%)
4	10	******************	(34.5%)
5	1	**	(3.5%)
6	1	**	(3.5%)
7	1	**	(3.5%)

MEAN 3.21 STANDARD DEVIATION 1.45

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	1	**	(2.7%)
2	1	**	(2.7%)
3	8	**********	(21.6%)
4	11	**********	(29.7%)
5	8	**********	(21.6%)
6	3	****	(8.1%)
7	5	*******	(13.5%)

MEAN 4.43 STANDARD DEVIATION 1.48

22. To what degree do you feel that creativity is required to be an effective buyer?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	0		
2	0		
3	1	**	(3.6%)
4	2	****	(7.1%)
5	8	**********	(28.6%)
6	8	**********	(28.6%)
7	9	**********	(32.1%)

MEAN 5.79 STANDARD DEVIATION 1.10

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	2	***	(5.3%)
2	3	****	(7.9%)
3	1	**	(2.6%)
4	5	*******	(13.1%)
5	8	**********	(21.0%)
6	12	**********	(31.6%)
7	7	*********	(18.4%)

MEAN 5.05 STANDARD DEVIATION 1.71

27. To what degree does your Purchasing Organization place emphasis on customer service?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	0		
2	1	**	(3.5%)
3	3	*****	(10.3%)
4	3	*****	(10.3%)
5	5	*********	(17.2%)
6	8	***************	(27.6%)
7	9	*****************	(31.0%)

MEAN 5.40 STANDARD DEVIATION 1.48

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	0		
2	1	**	(2.7%)
3	1	**	(2.7%)
4	3	****	(8.1%)
5	8	***********	(21.6%)
6	7	**********	(18.9%)
7	17	**********************	(46.0%)

MEAN 5.89 STANDARD DEVIATION 1.31

29. To what degree does your Purchasing Organization emphasize being the "best" in its industry?

INDUSTRY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	1	**	(3.5%)
2	1	**	(3.5%)
3	3	*****	(10.3%)
4	4	*******	(13.8%)
5	2	****	(6.9%)
6	7	**********	(24.1%)
7	11	**********	(37.9%)

MEAN 5.41 STANDARD DEVIATION 1.76

MILITARY

RESPONSE	FREQUENCY	PERCENT OF TOTAL RESPONSES 0...10...20...30...40...50...60	
1	1	**	(2.6%)
2	0		
3	4	******	(10.5%)
4	1	**	(2.6%)
5	3	****	(7.9%)
6	6	********	(15.8%)
7	23	**********	(60.5%)

MEAN 6.03 STANDARD DEVIATION 1.57

V. ANALYSIS OF THE DATA

It is evident from the data obtained during this study that there are significant differences in the ways that members of the industry and the military survey groups deal generally with procurement and specifically with purchasing productivity measurement. There were many organizational differences between the two study groups that have an impact on the way in which each measures purchasing productivity. This chapter will explore some of the possible reasons for these differences and discuss the implications for the organizations affected.

A. CURRENT MEASURES OF PRODUCTIVITY

There were clear differences in both the purchasing productivity systems used and the factors nominated for inclusion in an optimal measurement system by military and industry respondents to the survey used in this study. Perhaps the most significant of these differences was the military's reliance on efficiency measurements, while industry preferred a more balanced approach, using both efficiency and quality factors in their measurement systems. Industry survey respondents strongly rejected the use of efficiency measures alone to determine buyer performance. Several industry surveys were returned with such comments as,

"Our job is to buy quality, not just to meet a goal of buying so many parts per hour." The most frequently used measurements of productivity in military survey responses were the numbers of buys made in a period of time and backlog counts of unpurchased requisitions. The quality systems mentioned in military survey responses were auditing to uncover errors and customer feedback. Only three of the twenty-eight productivity measurement systems listed in the military surveys dealt with quality. This contrasts with a recognized need for quality measurements in purchasing productivity on the part of military survey participants. They answered question five, "To what degree do you feel that quality of buy factors are the most important in measuring purchasing productivity?" very positively. This paradoxical recognition of the need for quality measurements in theory and a lack of quality measures in practice is in part due to the difficulty of measuring quality factors productivity and in part due to the emphasis placed or the Productive Unit Resourcing System both at the activity and headquarters levels.

Industry survey responses indicated a more balanced approach to purchasing productivity measurement. Twenty-six of the forty responses to the question of "What purchasing productivity measurement systems are currently in use at your Purchasing Organization?" dealt with quality factors, while the remaining twenty referred to efficiency measures.

Timeliness of material delivery was most important of all quality measurements. Quality of the purchased material and cost performance as compared to historical or budgeted data were the next two most important aspects of quality cited by industry. The efficiency measure principally used was a backlog count. This measurement was also the most frequently cited system in use within the industry survey group.

There was greater diversity among the industry productivity measurement systems cited in the survey than in the military responses. This may be a reflection of the broad base of industry selected for the survey group. In general, the industry study group said that they select productivity measurements that make sense for the customers that they support within their own organizations. For example, if the customer was the production department of a shipyard, the purchasing department would buy material to support the production schedule. Productivity measurements are selected to track performance against timeliness of delivery and this goal becomes the key indicator of success for that purchasing department.

In the case of the military, purchasing has been centralized into regional procurement centers. The base of customers and their individual needs are very broad. It is very difficult to tailor a purchasing productivity measurement system to the diverse needs of all of the individual customers. Fewer and more general productivity

measurements have therefore been developed. The organization is further removed from its customers than are the purchasing organizations in the industry study group due to the military purchasing organization's centralized nature. Under such centralized organization, it is possible to become more responsive to internal management objectives and less so to those of the organization's customers. This is particularly true in the case of the public sector, where market forces are largely absent and a virtual monopoly on the service exists. In the military study group, the Productive Unit Resourcing System, a critical concern for internal activity management, formed the basis for activity performance measurement. In the industry study group, timeliness of delivery, a critical concern for the unit's customers, formed the basis of performance measurement.

B. PRODUCTIVITY MEASUREMENT PHILOSOPHY

An area of divergence between industry and military survey responses was on question four, "To what degree do you feel that the most important factor in productivity measurement is efficiency?" The industry responses showed a much lower acceptance of efficiency factors as important measures of purchasing Productivity than did the military responses. Several of the surveys returned from industry had comments that strongly disagreed with the use of any measurement system that emphasized how many or how fast contracts were completed. The feeling among the industry

respondents was that more emphasis should be placed on how well the purchasing department supported the production line with on time deliveries of material or with material that conformed in specifications and was therefore usable without delay. The penalty for late delivery appeared to be far more severe in industry than in the military. Several industry procurement managers confided during the interviews that a purchasing manager's reputation and success in purchasing was entirely determined by whether he could maintain the flow of material such that the production process was not delayed. This was particularly true in the industries that had switched to a just in time inventory approach.

On the surface this seems to be a curious finding. It would seem that the military's need to support national priorities world-wide and its operational commitments would make it more sensitive to the timely delivery of material than industry. If this were the case, timeliness of delivery would be a key military measurement parameter. It is not; in fact it is currently not measured by military contracting organizations at all. In the opinion of the researcher, the answer to this paradox lies in the organization and reporting requirements of both entities. In the case of the military, procurement is centralized into regional contracting centers with a variety of different customers. These regional contracting centers report to Navy Supply System Command. In a sense they have become detached from direct contact with

their customers and report to an organization that uses the Productive Unit Resourcing System as its major management tool. Industry procurement operations on the other hand are generally smaller and located in the company's plant along with the production department. There is great deal more interface with the internal company customers in the form of meetings, reports and actual daily contact. In the industry survey group the purchasing manager reported to either the materials manager or to the plant manager. In the military purchasing organizations, the purchasing manager reports to the Naval Supply Systems Command through his Commanding Officer. In industry there was a clear understanding that the purpose of the purchasing department was to support customer operations and to make a contribution to the overall effectiveness and profitability of the company. Current management of military contracting tends to emphasize the contribution to the efficient operation of the organization without a balancing measurement of the levels of customer support achieved. In fairness to the military regional contracting centers, they do respond quickly to customer complaints. However, the opportunities for direct interaction with customers in a centralized procurement organization are limited.

A further difference between the military and industry purchasing organizations in the study groups was the way in which each respective organization used the information

obtained from their purchasing productivity measurement systems. In the military, both the survey and interview results suggest very strongly that purchasing productivity measurements are used to evaluate individual and work group performance. In the survey the mean military response to the question, "To what degree does your Purchasing Organization depend on productivity standards to determine individual buyer effectiveness?", was 6.1 indicating a strong level of agreement, while the mean industry response to the same question was only 3.3. In the related question of, "To what degree does your Purchasing Organization depend on productivity measurement to determine overall departmental effectiveness?", the results were similar, a mean response of 6.3 for the military and 3.7 for industry. When two related questions were asked in the following way, "To what degree can purchasing productivity statistics be compared between individuals?" and "To what degree can purchasing productivity statistics be compared between work groups?", the military response was still significantly greater than the mean response of the industry survey group.

When these facts are combined with the data obtained in the interviews, the reasons for this difference become apparent. The interviews indicated that military purchasing productivity measurement systems are heavily based on efficiency measurement. This is the natural result of the Productive Unit Resourcing System and the directions received

from policy makers at higher levels. The only statistics kept at the headquarters level are efficiency measures, specifically Productive Unit Resourcing System goals performance, the backlog of unpurchased items and purchasing productivity expressed as the number of buys made per buyer hour. Purchasing productivity statistics are tracked over time with activities displayed side by side in management graphs. This further reinforces the comparative use of these statistics. Since the funding for a military activity is totally dependent on compliance with the Productive Unit Resourcing System and the activity cannot operate without funding, the Productive Unit Resourcing System eclipses all other activity performance measurement systems in importance. It emphasizes efficiency measurements because the system is based upon accomplishing certain levels of business within a set period of time in order to generate the funds needed to cover the activities' fixed operational expenses. The activities have calculated the level of output that must be achieved by each buyer in order for the activity to meet its annual Productive Unit Resourcing System goals. These production goals are stated as minimum levels of contracts to be awarded per hour for individual buyers. The most common standard established at the activities in the study group was two contracts per buyer per hour. The logical conclusion of this process is that these production goals will be used as the standard upon which performance of both individuals and

work centers will be based in the military procurement system.

There are several shortcomings in a one dimensional system that operates as does the one described above. However, this statement must be qualified. One must understand that military procurement operates under a vastly different set of conditions from those of industry. Quite often the military's business decisions are dictated by the realities of the budget process and political considerations. The focus of the current military purchasing productivity measurement system is fiscal responsibility and more efficient operation. These concerns are absolutely essential in the current political climate. This discussion is intended to point out the differences that exist between military and industry purchasing productivity measurement systems and to determine if the best parts of each system can be fused, while still operating within the constraints and realities of each organizational structure.

The military purchasing productivity measurement system does lack a degree of flexibility. There is little allowance in the rigid standards of production for inexperienced buyers or buyers who buy complicated commodities. Industry's chief complaint with efficiency measurements was that comparisons between buyers involved in buying material from different commodity groups would be meaningless. Factors such as buyer experience and the levels of difficulty associated with

buying various commodities are not considered when production goals are set as minimum rates of production needed to meet an annual Productive Unit Resourcing System goal.

A problem that arises when efficiency goals are established in terms of minimum production standards is that one tends to set an upper limit on the productivity and therefore output expected from each buyer. If the standard is stated in terms of minimum desired behavior, buyers may not do more than the minimum, particularly if there are no rewards for exceeding the goals. The military interviews indicated that this may be a significant problem. When a buyer does exceed the minimum standards for production, they are asked to take up the slack for less experienced or productive workers. The reward for hard work, therefore, is frequently more work to do. One industry survey participant summarized his company's position in this way:

> You cannot compare the productivity of buyers due to the complexities of individual buys. Our company policy is to reward good performance rather than to establish minimum standards.

The issue of quality under a system that emphasizes efficiency, is one worthy of special discussion. Military purchasing productivity measurement systems tend to measure largely efficiency factors. In terms of performance measurement systems, you are what you measure. Employees quickly learn what is expected of them and modify their behavior in order to conform and meet expectations. One

military survey respondent stated that when making buys, "I call whoever will give me the prices faster because we are always pushed to keep our backlog down." This type of behavior is indicative of a whole pattern of thought about what management wants and how best to accomplish it in order to conform with organizational expectations. Although it may be better to call several sources in order to get the best price, this process takes more time and in the final analysis it is backlog that management measures, not cost savings. One military buyer said in a survey response that as long as productivity and the Productive Unit Resourcing System go hand in hand, quality will take a back seat. An alternative to this situation would be to determine the key indicators of quality important to both the activity's customers and the contracting activity itself and then incorporate these measurements into the overall purchasing productivity measurement scheme. It is important to recognize that quality is one of the factors that can be traded off to increase output. Remembering that those things that are not measured are not controlled, makes it critical to measure quality under a purchasing productivity measurement system that strongly emphasizes efficiency. (3:37)

When both survey groups were asked if purchasing productivity was measurable or if it was useful to measure purchasing productivity at all, the military responses were consistently higher than those of the industry study group.

This indicated that the military felt more strongly than industry that you could and should measure purchasing productivity. This is in part due to the fact that the military measures efficiency factors which are relatively easy to quantify, while industry tends to evaluate more difficult areas like quality of the buy. The latter tends to be multi-determinant and difficult to quantify. This finding is also influenced by industry's rejection of efficiency factors alone as useful measurements of purchasing productivity and their reliance on a more balanced approach. Further, all military study group members have been directed to report Purchasing productivity statistics to higher authority. This requirement is largely absent in industry and may account for the wider acceptance of measuring purchasing productivity among the military study group.

The aspect of automation in the procurement process was addressed by two questions in the survey. The first asked, "To what degree does your purchasing organization use automation to assist buyers?" The military response to this question indicated, as expected, that there was more use of automation in that group than in the industry group. This was expected because all military activities in the study group were directed to implement the APADE system for procurements by the Naval Supply Systems Command. As was discussed earlier industry automation efforts ranged from complex systems to no systems at all. This illustrates some

of the benefits of participating in a large centrally managed organization such as the military. There is a high degree of uniformity in all the systems used in the military. This is the result of a centralized approach taken in the development of the system. Secondly, a large centralized organization can bring significantly more resources to bear on the problem than could a smaller group such as an individual small company.

The second question on automation of the procurement process asked, "To what degree do you feel that the use of automation improves purchasing productivity?" Again the military responses were more favorable than the industry responses. The interviews indicated that users of the APADE system were very satisfied with the product and the survey responses reflected this fact. Although their responses were less positive than those of the military, th industry survey group's answers did indicate that they felt that automation would improve purchasing productivity. Interviews indicated that simplification of recordkeeping and reporting to corporate levels were the primary automation benefits recognized by the industry study group.

C. OPTIMAL PRODUCTIVITY MEASUREMENT FACTORS

The survey asked respondents not only to list the measures of purchasing productivity that were currently in use at their purchasing organization, but to also define what factors could be included for purchasing productivity

measurement in the areas of quality and efficiency in order to give the best results. For efficiency measurement factors, essentially no new criteria were proposed by either military or industry survey participants. Industry proposed using buys made per unit time as its primary measurement and backlog of unpurchased items as its next most popular response. Military responses listed backlog first as the most nominated factor for efficiency measurement and buys made per unit time as the next most popular response. This is interesting as this is the reverse of the results found for the measurement systems that are currently in use in the military study group. Survey respondents listed buys made per unit time seven times more frequently than backlog counts in the military study group's list of currently used efficiency factors.

In both military and industry survey responses to the issue of which quality of buy factors should be included in purchasing productivity measurements, auditing to find contract errors was the most popular response. Industry had a much more balanced response pattern to this question. After auditing to detect errors, industry listed timeliness of delivery, cost of non-conforming or low quality material and cost performance against historical averages as the next three most important quality of buy measurements. These four measures of quality comprised 75% of the industry responses.

In contrast, the military surveys listed some form of audit as the best quality factor in 70% of the responses.

The purchasing productivity measurements suggested by the two survey groups and their answers to the survey questions can be explained in part by the way in which each is organized and operated. Cost was not a factor mentioned in the military survey group, but they do not function as a part of the for profit economy. It was not surprising that auditing was the most preferred quality factor in the highly regulated and inspected military survey group. The importance of timeliness of delivery was discussed above and its inclusion in the industry recommended quality factor list was not unexpected.

It was somewhat disappointing to see that the list of optimal measures for purchasing productivity requested by the survey was so similar to the list of current purchasing productivity measurements. One of the premises of this study was that there were improvements possible in purchasing productivity measurement systems and that brainstorming survey results might uncover some candidates for this improvement process. While the study did point out differences in individual measurement systems, it did not uncover new techniques that would be useful in creating a new purchasing productivity model . The next chapter will discuss recommendations for improvements to specific systems, but

these will represent a fusion of existing systems as opposed to the creation of a new process.

VI. RECOMMENDATIONS AND CONCLUSIONS

In the course of the research for this thesis, several observations have been made and many opinions formed by the researcher on the current state of purchasing productivity measurement. This chapter will address the research questions proposed at the start of the thesis and consolidate the data, opinions and observations into conclusions and recommendations for improvements. The recommendations that are made in this chapter represent areas that should be evaluated within the operating context of each organization using this report. The bottom line for management is to measure productivity in ways that make sense within their own organizational framework and constraints, while fully recognizing the limitations and benefits imposed by each productivity measurement system.

A. DISCUSSION OF THE RESEARCH QUESTIONS

The primary research question of this thesis asked whether there is an optimal way in which purchasing productivity could be measured. The data obtained in this research project suggests that there is not one optimal system currently in use, nor should one system be designed for universal application. Measurement means control and the parameters that management elects to control will differ

significantly for organizations. Whatever individual characteristics are selected for an organization's measurement, a balanced approach must be taken that includes the broad categories of both purchasing proficiency and purchasing efficiency. The term purchasing productivity meant different things to both study groups in this thesis. The industry study group favored a more balanced approach to purchasing productivity measurement and included both efficiency and quality factors in their systems. The military study group used efficiency factors exclusively and their measurement systems reflected this preference.

Current productivity measurement systems could be improved by adopting a more balanced overall approach to measurement system design. In the military study group, purchasing productivity measurement would benefit from the inclusion of effectiveness factors. The industry study group measured both efficiency factors and effectiveness factors, but tended not to use the efficiency factors to evaluate work group performance. Greater acceptance of these measures might reveal organizational inefficiency and therefore boost the purchasing organization's contribution to the company's bottom line. Automated procurement systems can assist in productivity measurement by tracking efficiency and effectiveness factors, using their report generation functions, in order to free managers from the tedious task of recordkeeping. Automated procurement systems could also see

buyers from relatively simple repetitive tasks so that their time can be spent resolving more complex procurement problems.

B. CONCLUSIONS

1. Conclusion 1

There is no one optimal purchasing productivity measurement system. It is very clear from the data in this thesis that there is no one purchasing productivity measurement system that has achieved universal acceptance. Rather, there exists a mixture of several systems using various parameters that are chosen based on what management has selected as key success parameters. In the case of the military study group, the parameter chosen most often was efficiency measurements based upon the number of buys made per unit time. The military study group was much more uniform in the parameters that were measured due to the highly centralized nature of their organization. The industry study group exhibited a wider range of purchasing productivity measurements, with a tendency towards a more balanced approach, including efficiency factors as well as effectiveness factors into their systems.

2. Conclusion 2

The industry study group showed a strong preference for quality measurements over efficiency measurements alone in their purchasing productivity measurement systems. The military study group showed an equally strong preference for

efficiency measurements alone, with the quality factors of cost, timeliness of delivery and non-conforming material largely unmeasured. The researcher concludes that this finding is directly related to the ways in which each organization defines desired performance. In the military study group compliance with the Productive Unit Resourcing System represents the primary desired performance, while in the industry study group more attention is given to the quality and customer support aspects of purchasing.

3. Conclusion 3

There was a strong tendency in the military study group to use purchasing productivity measurements as comparisons of performance between individuals and workgroups. The industry study group soundly rejected the notion that purchasing productivity measurements could be used to compare individuals or workgroups due to the diverse nature and individual complexities of contracting for various commodity groups.

4. Conclusion 4

It is not very useful to evaluate purchasing productivity measurement in terms of a single indicator. Purchasing represents a series of trade-offs in many areas, including cost, quality, delivery and efficiency. It is possible to obtain very low prices or high efficiency rates at the expense of quality or delivery. The best purchasing decision often represents the evaluation of many factors

without an attempt to minimize any one area. Instead, all factors must be held in the balance and the best overall solution chosen. For this reason, purchasing productivity measurement systems should be multi-determinant. To use only one criterion for purchasing productivity measurement, ignores the other aspects of procurement and encourages behavior that can be contrary to good business sense.

5. Conclusion 5

The military study group favored Contract Administration staffs to process contracts after award, while the industry study group did not. Industry favored a cradle to grave approach to contracting. They felt that buyers should be responsible for material until it was actually in the customer's hand. All quality or contract problems were to be resolved by the purchasing agent that made the buy. Reasons given for this approach were that vendors were more likely to respond to buyers in resolving product problems as they represented the salesmen's next paycheck and it influenced better up front quality if the buying agent was totally responsible for the contract.

6. Conclusion 6

The impact that APADE has had on purchasing productivity cannot be determined at this time. There have been several changes to the way in which baseline productivity measurements has been made during the implementation cycle for APADE. The latest change in

February of 1988 was an attempt to standardize productivity calculations at Navy Field Contracting Activities. All that can be said with certainty is that productivity declines as an activity transitions onto the APADE system and that this negative productivity trend is reversed during the next several months of operation. The impact of APADE on productivity must be carefully evaluated over time, holding the productivity measurement system constant, in order to determine the productivity gains realized.

7. Conclusion 7

It is concluded that the APADE system has achieved a high level of customer satisfaction with management and buyers in the military study group. Automation of the procurement process is recognized as beneficial both in the industry and military study groups. The industry study group has not acted to become as fully automated in procurement as the military study group.

C. RECOMMENDATIONS

1. Recommendation 1

Naval Supply System Command activities should consider including quality measurements as part of their purchasing productivity measurement systems. The emphasis should be on the use of the APADE system to collect productivity data to insure uniformity and to ease the administrative burden of collection. One factor that could be considered is timeliness of delivery measured in terms of

both the customer's required delivery date and the contract delivery date. A second factor that could be considered is cost performance as measured against historical or average cost. Both of these factors are widely used in industry and lend themselves to being easily tracked on the APADE system.

2. Recommendation 2

Quality performance measurements should be for local level use and not be reportable to the headquarters level. This will reduce the pressure to "sweeten" the statistics and allow the information to be free from many of the biases that would otherwise exist. The information should then be used to influence decisions at the local level and make improvements where warranted. Overall quality compliance should still be checked as a part of the activities contracting inspection.

3. Recommendation 3

Industry should pursue more aggressively automation of the procurement process. Procurement decisions are already extremely complex involving trade-offs in cost, delivery and quality. Further complicating factors include the huge regulatory requirements of doing business with the government and the growing numbers of offshore procurements. These factors, coupled with the large volume of purchased material needed to support industry today, are beginning to overwhelm the human ability to make the best decision. Automation, even in its most elementary form of record

keeping, will free the purchasing agent to handle the more complex areas of procurement.

4. Recommendation 4

Industry should review its aversion to using efficiency statistics in the comparisons of work groups or individuals. The suggested approach would be to evaluate trends of productivity between groups over time rather than to compare raw productivity scores. By doing this and noting the changes, the manager will be able to recognize areas of his business that may be growing in complexity and allocate additional resources.

5. Recommendation 5

Military procurement organizations should investigate whether Contract Administration staffs can be used as quality monitors for the procurement process. Several surveys suggested using the number of contract modifications executed by the Contract Administration staff as an indicator of contract document quality. Not every contract modification represents a contract error. To identify those modifications that do result from an contract error, one activity simply tasked the Contract Administration staff to screen all contract modifications and make a decision on what caused the modification. If the modification was determined to be the result of a contract error, the type and responsibility of the error was determined. This information was made available to management.

6. Recommendation 6

Information on contract error rates obtained through audits should be the subject of organizational training rather than addressed individually with buyers. This will correct the deficiency with those who do not understand the procedure, while reinforcing the correct procedure for all others. It also prevents a "big brother" atmosphere from developing where one's every mistake returns to haunt them. An exception to this procedure would be the habitual offender. In this case other managerial tools must be brought to bear.

7. Recommendation 7

Productivity measurement systems should be held constant over any period of time during which a new system, such as APADE, is being implemented. Statements about such a system's impact on productivity cannot be made if changes are made to the productivity measurement system.

8. Recommendation 8

Future implementations of the APADE system should include a recommended organizational structure based upon the lessons learned from prior implementations. An evaluation of the workload and unique processes at the implementing activity should be conducted prior to the implementation date and the results incorporated into the recommended organizational structure. This process could significantly

reduce initial productivity drops during the APADE start-up process.

APPENDIX A

SURVEY USED IN THE STUDY

Purchasing Productivity Survey

This survey is designed to collect the opinions of purchasing professionals like yourself for a masters degree research project at the Naval Postgraduate School. Please take a few moments from your busy schedule to complete it today.

The area being studied is purchasing productivity measurement systems. The information obtained through this survey will be completely confidential and will not specifically identify any individual or organization. The information from this survey and the subsequent report will add to the growing body of knowledge regarding contracting and further the professional nature of our field.

Thank you for your time and responses.

.. Productivity can be defined as a measurement of how efficiently and effectively an organization accomplishes its objectives. In general, efficiency measurement compares inputs to outputs to get a quantitative indicator of productivity. Effectiveness factors are harder to quantify and therefore are often dealt with in organizationally unique ways. What specific measures of purchasing productivity are used in your organization? (For example, the number of items bought per hour for a buyer.)

2. Purchasing productivity has been described as consisting of two parts. The first is the efficiency factor which relates to how quickly and efficiently each buy is made. The second factor is the quality factor. It measures how "good" a buy was made. What efficiency factors do you think could be included in purchasing productivity measurement to give the best results? (For example, the backlog of items to buy.)

3. What quality factors do you think could be included in purchasing productivity measurement to give the best results? (For example, contract errors found by contract administration.)

Below are 33 questions. Please circle your response on the scale for the item.

Response scale:
1 - To little or no degree
2 - To a slight degree
3 - To some degree
4 - To a moderate degree
5 - To a considerable degree
6 - To a great degree
7 - To a very great degree

		Circle response
1.	To what degree do you feel that it is useful to measure purchasing productivity?	1 2 3 4 5 6 7
2.	To what degree do you believe that productivity objectives are measurable?	1 2 3 4 5 6 7
3.	To what degree do you feel that purchasing productivity should measure both efficiency factors (how fast a buy is made) and quality factors (how "good" a buy is made?	1 2 3 4 5 6 7
4.	To what degree do you feel that the most important factor in productivity measurement is efficiency?	1 2 3 4 5 6 7
5.	To what degree do you feel that quality of buy factors are most important in measuring purchasing productivity?	1 2 3 4 5 6 7
6.	To what degree do you feel that to increase buying efficiency you must sacrifice buying quality?	1 2 3 4 5 6 7
7.	To what degree do you influence the productivity goals set for your job?	1 2 3 4 5 6 7
8.	To what degree can you adjust your productivity goals as needed?	1 2 3 4 5 6 7
9.	To what degree do you feel stressed by pressure to meet productivity goals?	1 2 3 4 5 6 7
10.	To what degree do managers in your Purchasing Organization seem to believe that tighter control produces increased productivity?	1 2 3 4 5 6 7
11.	To what degree are the productivity goals of your Purchasing Organization realistically obtainable?	1 2 3 4 5 6 7
12.	To what degree does your Purchasing Organization depend on productivity standards to determine individual buyer effectiveness?	1 2 3 4 5 6 7

Response scale:
1 - To little or no degree
2 - To a slight degree
3 - To some degree
4 - To a moderate degree
5 - To a considerable degree
6 - To a great degree
7 - To a very great degree

		Circle response
13.	To what degree does your Purchasing Organization depend on productivity measurement to determine overall departmental effectiveness?	1 2 3 4 5 6 7
14.	To what degree does your Purchasing Organization use automation to assist buyers?	1 2 3 4 5 6 7
15.	To what degree do you feel that the use of automation improves purchasing productivity?	1 2 3 4 5 6 7
16.	To what extent does your Purchasing Organization hold individials accountable for productivity?	1 2 3 4 5 6 7
17.	To what extent is your work group held accountable for productivity as a unit in your Purchasing Organization?	1 2 3 4 5 6 7
18.	To what degree can purchasing productivity statistics be compared between individuals?	1 2 3 4 5 6 7
19.	To what degree can purchasing productivity statistics be compared between work groups?	1 2 3 4 5 6 7
20.	To what degree can purchasing productivity statistics be compared between different Purchasing Organizations?	1 2 3 4 5 6 7
21.	To what degree do you feel that there is variation in the purchasing methods used in your Purchasing Organization?	1 2 3 4 5 6 7
22.	To what degree do you feel that creativity is required to be an effective buyer?	1 2 3 4 5 6 7
23.	To what degree are you personally commited to the productivity goals of your Purchasing Organization?	1 2 3 4 5 6 7
24.	To what degree is your Purchasing Organization making observable progress toward its productivity goals?	1 2 3 4 5 6 7
25.	To what degree are the productivity standards that have been set up for your job difficult to meet?	1 2 3 4 5 6 7

Response scale:
1 - To little or no degree
2 - To a slight degree
3 - To some degree
4 - To a moderate degree
5 - To a considerable degree
6 - To a great degree
7 - To a very great degree

		Circle response
26.	To what degree are the managers in your Purchasing Organization pressured to produce high productivity rates?	1 2 3 4 5 6 7
27.	To what degree does your Purchasirg Organization place emphasis on customer service?	1 2 3 4 5 6 7
28.	To what degree are you committed to achieving organizational excellence?	1 2 3 4 5 6 7
29.	To what degree does your Purchasing Organization emphasize being the "best" in its industry?	1 2 3 4 5 6 7

Circle the appropriate response for the following items.

30. The type of organization that you work for is

1 - military
2 - public service sector
3 - private industry

31. Your job is considered to be

1 - management
2 - buyer with management responsibility
3 - buyer

32. How long have you been a member of the purchasing profession?

1 - 0-2 years
2 - 2-5 years
3 - 5-10 years
4 - 10-15 years
5 - over 15 years

33. Which of the following factors does your Purchasing Organization use to measure purchasing productivity?

1 - efficiency factors
2 - quality factors
3 - both

APPENDIX B

SUMMARY SURVEY RESULTS FOR EACH QUESTION

[illegible]
[illegible]

1 = To little or no degree 2 = To a slight degree
3 = To some degree 4 = To a moderate degree
5 = To a considerable degree 6 = To a great degree
7 = To a very great degree

item	responses	average	std dev	1...2...3...4...5...6...7
1.	38	5.2	1.4	******************
2.	35	4.7	1.2	****************
3.	37	5.9	1.2	*********************
4.	38	5.1	1.4	*****************
5.	38	5.7	1.0	********************
6.	38	3.5	2.2	***********
7.	38	4.0	2.1	*************
8.	37	3.6	1.9	***********
9.**	3[illegible]	3.0	1.9	*********
10.**	37	2.9	1.7	********
11.	37	4.6	1.3	***************
12.	3[illegible]	6.1	1.1	*********************
13.	38	6.3	0.9	**********************
14.	38	5.3	1.7	******************
15.	38	5.1	1.7	*****************
16.	37	5.3	1.7	********************
17.	37	5.4	1.4	*******************
18.	3[illegible]	4.7	1.7	****************
19.	37	4.4	1.5	***************
20.	37	4.2	1.6	**************
21.	3[illegible]	4.7	1.8	****************
22.	3[illegible]	5.1	1.7	*****************
23.	37	6.0	1.7	*********************
24.	3[illegible]	5.1	1.3	*****************
25.**	3[illegible]	3.9	1.6	*************
26.**	3[illegible]	2.4	1.4	******
27.	37	5.9	1.7	********************
28.	3[illegible]	6.2	1.1	**********************
29.	3[illegible]	6.0	1.6	*********************
Overall		4.9	1.8	****************

** = negative items - scale reversed for comparison

[illegible] Questionnaire Survey
Private Industry

1 = To little or no degree 2 = To a slight degree
3 = To some degree 4 = To a moderate degree
5 = To a considerable degree 6 = To a great degree
7 = To a very great degree

Item	responses	average	std dev	1...2...3...4...5...6...7
1.	29	4.7	1.7	**********
2.	29	3.9	1.3	**********
3.	29	4.6	1.8	**********
4.	29	3.8	1.6	**********
5.	29	5.4	1.2	**********
6.	29	2.9	1.9	********
7.	29	4.3	2.0	**********
8.	29	4.1	2.0	**********
9.**	28	4.1	1.5	**********
10.**	29	3.7	1.6	**********
11.	29	4.4	1.4	**********
12.	29	3.3	1.7	**********
13.	29	3.7	1.8	**********
14.	29	4.4	1.6	**********
15.	29	5.5	1.3	**********
16.	29	3.9	1.6	**********
17.	29	3.9	1.5	**********
18.	29	3.3	1.6	**********
19.	29	3.2	1.4	**********
20.	28	2.9	1.5	********
21.	29	4.0	1.8	**********
22.	29	5.9	1.1	**********
23.	29	5.5	1.5	**********
24.	29	4.7	1.4	**********
25.**	26	4.9	1.2	**********
26.**	29	4.0	1.7	**********
27.	29	5.5	1.5	**********
28.	29	6.2	1.0	**********
29.	29	5.4	1.3	**********
Overall		4.4	1.3	**********

** = negative items - scale reversed for comparison

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